NASA NRT Workshop

Workshop to Develop a Portfolio of Low Latency Datasets for Time-Sensitive Applications

27 - 29 September 2016

Reid Conference Center, Langley Research Center, Hampton VA.

- **Final Meeting Report**
- **AGU 2016 Presentation: Outcomes of the NRT Workshop**
- **Link for the NRT data inventory** (google sheets)

Agenda, Abstracts and Presentations

Tuesday 27th September 2016

8:00am	Registration & Check-in and Coffee	
9:00am	Molly Brown and/or Diane Davies	Welcome to Workshop
9:05am	Michael Freilich, NASA HQ,	**Charge of the workshop and NASA Earth Science priorities** (15 minutes for Q&A) (Remote presentation)
10:05am	David Green, NASA HQ	**Applied Science Perspective**
10:20am	Christine Bonniksen, NASA HQ	**Mission perspective on support for NRT data production** (5 minutes of Q&A) Near Real-Time requirements can enhance the usefulness of science data. Currently this consideration is often an afterthought in the design of a NASA science mission. This presentation will address some of the ways to incorporated Near Real-Time considerations into the mission design process.
10:45am	Kevin Murphy, NASA HQ	**Increasing the utility of NASA's NRT data and services inventory**

11.00am	Chris Justice, UMD, LANCE User Working Group Chair	**LANCE NRT data and the role of UWG and key end users** The Land Atmosphere Near-real-time Capability for EOS (LANCE) was initiated by the NASA Flight, Research and Applied Sciences Programs in 2009, to ensure availability of NASA data products in NRT to those partners who rely on these data for their Decision Support Systems. The goal was to: i) gather multiple independent NASA NRT systems under a common umbrella and increase consistency of service, ii) increase awareness of the availability of NASA NRT data sets, iii) provide feedback and metrics to NASA HQ and improved management oversight, iv) improve communications with the user community and science teams. Since its inception LANCE has expanded to include other NASA missions. The Lance User Working Group (UWG) was modeled on the EOS DAAC UWGs, managed by ESDIS. The UWG is a mechanism to guide the development of LANCE, review current system performance and proposed capabilities, understand the obstacles to current NRT data use and user needs for future capabilities and help guide the planning for NRT data from new and future NASA Missions.
11:40am	Kelvin Brentzel, Direct Readout Laboratory, NASA GSFC	**Direct Readout Laboratory and their provision of NRT data** The Direct Readout Laboratory (DRL) has been serving the NASA and NOAA Direct Readout Communities since before the launch of Terra. The high spacial and spectral resolution instruments of the EOS era paved a shift from L-band to X-band; that sufficient transmitted bandwidth would be available to an evolving direct readout community. The DRL worked with the broader community in those early years to bring down the cost of an X-band system from $1.5M to $150k within a period of several years. This made X-band use by the broader community a viable solution for the legacy L-band users from POES, whereby a new relationship between NOAA and the DRL was born that DRL supported through Suomi-NPP launch. Today we have a diverse community where emerging technologies, algorithms and increasing end-user applications yield new enterprises beyond government institutions to stimulate a growing commercial real-time and near real-time exploitation of Earth science data. At this LANCE UWG the DRL will present the state of technology and algorithms utilized by the growing direct broadcast community from a perspective of over 3000 DRL Portal registered users.

12:00pm	Will Stefanov, Associate ISS Program Scientist for Earth Observations, NASA JSC	**Overview of the Near-Real Time Data Potential of the International Space Station** William L. Stefanov[1] The International Space Station (ISS) is a unique terrestrial remote sensing platform for the collection of disaster response imagery. The unique aspects include: a human crew that is capable of obtaining imagery using handheld digital cameras; a changing complement of both internal and externally-mounted remote sensing instruments; and an inclined equatorial, low-Earth orbit that provides the opportunity to obtain data under varying lighting conditions and overpass times (day and night) over 95 percent of the inhabited surface of the Earth. As such, the ISS provides a useful complement to autonomous sensor system platforms in higher altitude polar orbits. I will provide a general overview of the ISS as an Earth observations platform, including ISS data infrastructure and commanding/data downlink capabilities with a focus on currently operational imager systems (the Crew Earth Observations Facility, and High Definition Earth Viewing video camera system). The operational process for engaging NASA imaging assets on the ISS for International Disaster Charter activation response and delivery to the USGS Hazards Data Distribution System will be discussed, using current and planned NASA and CASIS-funded remote sensing systems to illustrate the potential (and constraints) for low-latency data collection and delivery from the ISS. --- ***[1] Earth Science and Remote Sensing Unit, Astromaterials Research and Exploration Science Division, Exploration Integration and Science Directorate; and International Space Station Program Science Office, NASA Johnson Space Center, Houston, TX 77058 (email: william.l.stefanov@nasa.gov)***

12:20pm	Alex Fore, JPL	**RapidScat Near-Real-Time Observations of Ocean Surface Winds from the International Space Station** Alexander Fore, Bryan Stiles, Alexander Wineteer, Charles Miyamoto, and Ernesto Rodríguez[1] In this talk we discuss the RapidScat scatterometer which is installed on the International Space Station (ISS). Scatterometers are microwave radars which make highly accurate estimates of the normalized radar cross-section. For ocean applications we can estimate the ocean surface wind vector using scatterometers. Scatterometery is a mature application of microwave radar and many missions been in operational use since the late 1990's starting with NASA scatterometer and Quick Scatterometer (QuikSCAT). RapidScat was a very quick (2 years) adaptation of left over parts of QuikSCAT to the International Space Station (ISS). RapidScat was installed on the ISS in late Sept 2014 and near-real-time data was flowing to operational weather forecasting agencies worldwide within 5 weeks. We discuss the various user groups for RapidScat and the latency of the data products delivered to each. Finally we discuss some of the issues and challenges we faced with operating an always-on NRT instrument on the ISS as well as specific issues regarding operating a radar instrument on the ISS. [1] Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109 USA (e-mail: **Alexander.Fore@jpl.nasa.gov**).
12:30 pm	Don Sullivan, and Jay Al-Saadi, NASA LARC	**NRT from field campaigns** We will be discussing the campaigns supported by the NASA Airborne Science program that, due to potential life or property loss, require near real time data delivery to modelers, forecasters and incident commanders. Emphasis will be on EV campaigns, but small exercises, and the infrastructure developed will also be covered.

12:50pm	Ryan Boller, NASA GSFC	**The Common Metadata Repository, the Earthdata Search Client and Worldview: ESDIS tools that could be leveraged towards a NRT Portal (link to google docs version), PDF Version** This talk will provide an overview of existing NASA capabilities to access, visualize, and download Earth data as they relate to NRT applications. The goal is to provide a basis for the following day's discussion to determine how we might customize these existing capabilities to build an NRT-specific portal.
1:10pm	Lunch Break	
2:00pm	Michael Goodman, NASA MSFC	**The International Space Station Lightning Imaging Sensor (ISS LIS) (without ISS video)** The International Space Station Lightning Imaging Sensor (ISS LIS) is a space-based instrument to detect the distribution and variability of total lightning (cloud-to-cloud, intracloud, and cloud-to-ground) during both daytime and nighttime. The ISS LIS instrument will be launched aboard the SpaceX-10 rocket in 2017 and will be robotically installed on the Express Logistics Carrier-1 frame externally attached to the ISS. The ISS LIS will fly in a low earth orbit with a latitude range +/- 54 deg, which covers the geographic range of 98% of global lightning. The ISS LIS instrument is the “sister” of the original TRMM LIS, which flew aboard the Tropical Rainfall Measuring Mission satellite from 1997-2015. The TRMM LIS had an outstanding track record of making global lightning detection of the tropics (+/- 35 deg) for over 17 years. Lightning detection from space allows monitoring of areas that have few ground stations. While the primary goal of the LIS has always been and continues to be to create long-term climate data records of lightning around the world for research, generating ISS LIS lightning products in near-real time and combining them with other sensor data could certainly enhance rapid response systems in such areas as forest fire detection, severe thunderstorms, and possibly as a precursor to tornado development. Real time data from ISS LIS may find special warning and forecast applications in data sparse regions of the globe, such as over the oceans.

2:10pm	Dan Ziskin, NCAR - Atmospheric Chemistry Observations & Modeling Laboratory	**Measurement of Pollution in the Troposphere (MOPITT) NRT** MOPITT is a satellite instrument flying aboard TERRA, measuring CO in the upper Troposphere. The MOPITT SIPS currently produces NRT products and places them on an ad hoc ftp server where they are downloaded and used for atmospheric chemistry modeling and field experiment planning. We are requesting authorization to become a LANCE Element because we believe that a more dedicated and formal structure will encourage broader usage of MOPITT NRT data. Development will occur in the fall of 2016 and operational deployment should happen in early 2017. This activity will be covered by already allocated SIPS funding so there will be no accompanying request for additional funds.
2:20pm	Molly Brown	Introduction of breakout group topics, objectives and directions (**powerpoint showing BO group rooms**)
2:30pm	Portfolio development and gap identification for NRT data products, and discussion of NRT science questions. Outcomes: Each group should review the NRT portfolio and further the inventory, discuss the challenges, opportunities, data availability, and data needs for each application area Each group must report at least two conclusions from the breakout group in a single PowerPoint slide LANCE user working group in parallel session - Room 113	
4:30pm	Reports back from groups (5 minutes each)	*Designated reporter from each group with 1 PowerPoint slide*
5:20pm	Open Discussion	
6:00pm	Molly Brown	Conclusions, start time on Day 2, and invitation to Social
6:05pm	*NRT Social and Poster Session at Cafeteria area*	

Wednesday 28th September 2016

8:00am	Coffee, Registration & Check-in	
	Speaker	Topic
9:00am	Molly Brown and/or Diane Davies	Welcome to Day 2 – Goals and objectives for second day of the workshop

9:10am	Lawrence Friedl, NASA HQ	**Applications perspectives and sources of data in the context of GEO and other data partnerships**
9:30am	Brenda Jones, USGS	**Hazards Data Distribution System / NRT Landsat** The use of remotely sensed imagery in the aftermath of a disaster can have an important impact on the effectiveness of the response for many types of disasters such as floods, earthquakes, volcanic eruptions, landslides, and other natural or human-induced disasters. Ideally, responders in areas that are commonly affected by disasters would have access to archived remote sensing imagery plus the ability to easily obtain the new post event data products. The cost of obtaining and storing the data and the lack of trained professionals who can process the data into a mapping product oftentimes prevent this from happening. USGS Emergency Operations provides remote sensing and geospatial support to emergency managers by providing access to satellite images from numerous domestic and international space agencies including those affiliated with the International Charter Space and Major Disasters and their space-based assets and by hosting and distributing thousands of near real time event related images and map products through the Hazards Data Distribution System (HDDS).

9:50am	Stuart Frye, NASA, GSFC	**Near Real-Time data for CEOS and GEO** Rapid delivery and processing of disaster maps from Earth observation satellites and aerial platforms are being used more and more by the disaster response community, even though those end users don't have their own capabilities to access and process the raw satellite data. Improved access to map products for natural and man-made disasters is being enabled through activities sponsored by the Committee on Earth Observation Satellites and the Group on Earth Observations through the proliferation of automated web services with machine-to-machine application programmer interfaces combined with the scaling down of products from gigabyte raster images to vector-based formats that can be easily combined as map layers by these end users into their own analysis platforms. This talk will highlight the satellite sources, delivery mechanisms, processing techniques, data formats, and web service interfaces that are becoming more and more a part of normal disaster response protocols at the state, national, regional, and international level
10:10am	Mike Little, NASA HQ	**Advances in technology: improving delivery and accessibility of NASA's NRT data** For over 20 years, Earth Science Technology Office (ESTO)'s Advanced Information Systems Technology (AIST) Program is responsible for identifying and maturing technologies that NASA's Earth Science Division might need in the 5-20 year time frame. These technologies range across the entire data life cycle and are typically between TRL 2 and 6 with some extension in the 7 for demonstration purposes. The bulk of the funding is used in competed research among NASA, universities and industries participants and has placed a growing emphasis on early engagement of flight projects and research and applied sciences communities to improve their influence on the direction that development takes. ESTO and AIST also conduct studies of the needs of NASA's Earth Science community needs in specific technology areas and of the usability of those areas in meeting the future needs of the community. AIST uses the Earth Science Information Partners (ESIP) Federation to conduct independent evaluations of the selected technology Projects. AIST Projects rely on community resources, such as those provided by EOS-DIS, open source and Agency commercial licensing to avoid duplication and to emphasize focus on the new technology advances needed. AIST also encourages the application of Amazon Web Services (AWS) Public Cloud computing, through the AIST Managed Cloud Environment. This talk will provide an overview of the Program and a review of past AIST Projects related to NRT.

10:30am	Ana Prados, UMBC	**NASA Applied Remote Sensing Training (ASRET): Building Capacity to access and use NASA NRT products** NASA's Applied Remote Sensing Training (ARSET) program builds the technical skills to integrate NASA Earth Science data into agency's decision-making process. The program has reached +7500 end-users in +140 countries through online and onsite training for air quality, disasters, health, land, water, and wildfire management. ARSET's methodology for improving access and use of NASA NRT products includes: 1) a learning approach combining multiple forms and levels of training, 2) collaboration with NASAs DAACs through participation in User Working Groups and input on data tool development, and 3) the integration of end-user feedback and program assessment throughout the training lifecycle.
10:50am	Coffee break	
11:20am	Bob Tetrault US-FAS and Chris Justice, UMD/ GEOGlam	**Agricultural and Drought Monitoring** USDA's Foreign Agricultural Service uses satellite observations and converts them into market intelligence within USDA's economic information system. Time-sensitive satellite observations are highly valued in this process for agricultural monitoring and analysis of freezes, droughts and bumper crop conditions. The observations must meet low latency measurements in order to be used within the calendar of meetings—USDA's lockup process. If low latency requirements are not met then the satellite observations' value diminishes greatly. **GEOGLAM** The GEO Global Agricultural Monitoring (GEOGLAM) activity is supporting and promoting the use of Earth Observations for operational agricultural monitoring around the World. Given the time-sensitivity of agriculture, NRT data play an important role. Currently EOS MODIS data from the LANCE system are being used for monitoring crop condition and experimentally for estimating crop production. The addition of Suomi-NPP VIIRS data into LANCE is underway with a view to the eventual replacement of MODIS by VIIRS for global agricultural monitoring.

11:40am	Brad Zavodsky, NASA SPoRT	**Use of Satellite Data within Weather Decision support systems** The NASA Short-term Prediction Research and Transition (SPoRT) Center is an end-to-end research-to-operations/operations-to-research (R2O/O2R) activity focused on improving short-term weather forecasts through the use of unique NASA satellite data and modeling capabilities in order to demonstrate societal benefit. SPoRT has provided more than 40 experimental products to over 30 National Oceanic and Atmospheric Administration (NOAA) National Weather Service (NWS) forecast offices and 5 National Centers—including the Weather Prediction Center—over the last 15 years. Recent advancements in product development, data dissemination, modeling and data assimilation, product applications in various decision support systems, and transition, training and assessment activities have significantly helped to improved operational weather forecasts and have provided for the more effective detection, monitoring, and community response to natural disasters. Latency is one of the primary data challenges for SPoRT. Operational forecaster feedback suggests that products needed to support real-time weather situational awareness need to be available less than 30 minutes after observation. Observations that fail to meet this requirement may still be useful, depending on the forecast challenge; however, it is more likely that these observations are more useful for post-event analysis, case studies, or model verification. While these are useful applications of NASA datasets, there is no direct impact on the decision-making process during an event. This presentation will discuss ways that SPoRT has collaborated with NRT data providers, such as the Land Atmosphere Near real time Capabilities for EOS (LANCE) at Goddard Space Flight Center, to minimize latency for products from partners in the operational weather community and some datasets and challenges that remain.

12:00am	Wilfrid Schroeder, UMD and Brad Quayle USFS RSAC	**Fire data and users** Routine near real-time (NRT) satellite fire detection data serve a large number of users globally. The EOS/MODIS fire product was one of the first NRT data sets to experience widespread dissemination of applications ranging from fire monitoring and alert systems, to strategic fire fighting resource allocation, to air quality modeling. NASA LANCE and IPOPP spurred several NRT MODIS fire data systems each serving hundreds to thousands of users consulting fire locations on a daily basis. That legacy will continue into the next decade with JPSS/VIIRS. Introduced in late 2015, the VIIRS 375 m NRT fire data set is a significant improvement over the 1 km MODIS data. The refined spatial resolution data enabled the development of new applications exploring the synergy between satellite observations and modeling. For the first time a coupled weather-fire modeling framework was successfully initialized for a wildfire already in progress using VIIRS 375 m NRT fire perimeter data generating accurate fire spread information until the next available satellite overpass 12 h later. Complementing VIIRS, Landsat-8 and Sentinel-2a/b fire detection data offer a whole new perspective towards landscape fire management. The refined spatial information and the gradual increase in observation frequency make those data sets ripe for consumption although expanded data acquisition strategies (e.g., nighttime observations) and latency capabilities must still be addressed in order to fully explore their NRT applications potential. Together, VIIRS and Landsat-class fire data now provide key insight into tactical level fire data applications often mimicking the information content of more scarce airborne fire mapping resources.

12:20am	Dave Winker, NASA LARC and Kim Richardson, NRL	**CALIOP- derived NRT aerosols applied in NRL NRT data products** Most operational forecast centers now have or are developing an aerosol forecast capability. It is generally recognized that forecasts can be improved by incorporating radiative effects of dust and, further, global aerosol predictions are needed to set boundary conditions on regional air quality and chemistry models. Assimilation of MODIS AOD has been shown to improve model performance and is now used operationally at some forecast centers, but does not provide constraints on aerosol vertical distribution. Thus there is interest in further improving aerosol forecasts by assimilating lidar profile data, and initiatives using CALIOP data are underway at several operational forecast centers. Interest from the modeling community in 2010 prompted the CALIPSO team to develop a specialized near-real time (NRT) product suitable for assimilation by operational centers. This product has been available to operational centers since 2011 for use in off-line development and testing of assimilation schemes. Recent experiments have demonstrated that assimilation of CALIOP aerosol profiles improves the skill of aerosol forecasts from the US Navy forecast model **NRT Satellite Support to Research for Operations back to Research**: Near real time (NRT) support for Navy operational assets started in 1995 with the establishment of the ground station at NRL Monterey. In the early days of the internet NRL Monterey was one of the first agencies to provide NRT satellite imagery via a web browser. NRL was one of the original Near Real Time Processing Effort (NRTPE) members. Some say the origin of NRTPE was from a meeting between NASA's King and NRL's Hawkins during a conference in the early days of Terra and Aqua to reduce the MODIS latencies from 6-10 hours down to below 3 hours. NASA has provided NRT support to NRL for early adaption of TRMM, GPM, and several scatterometers. Transition of value added products to Navy operations has also lead to feedback which in turn as resulted in additional research projects.
12:40pm	Lunch Break	

1:40pm	Jim Szykman, LARC	**Low Latency Datasets for Time-Sensitive Applications under the U.S. EPA AIRNow Program: Regional-to-Global Air Quality** The U.S. Environmental Protection Agency's (EPA) AIRNow program provides both near-real-time and forecast for the Air Quality Index (AQI) across the United States. AIRNow is also used to support EPA and Department of State effort to provide air quality information international through AIRNow International (AIRNow-I) and AIRNow-Department of State (AIRNow-DoS). This talk will discuss the use of current low latency satellite data from the Aqua and Terra MODerate resolution Imaging Spectroradiometers (MODIS) used to support the AirNow Satellite Data Processor (ASDP), as well as additional satellite data products, either currently used to support AIRNow AQI forecast, or with the potential to support AIRNow, AIRNow-I, or AIRNow-DoS. Disclaimer: Although this work was reviewed by the U.S. Environmental Protection Agency and approved for publication, it may not necessarily reflect official Agency policy.
2:00pm	Patrick Minnis, NASA LaRC	**NRT of NASA Langley Satellite Imager-Based Cloud Property and Clear Sky Temperature Retrieval Datasets** The NASA Langley Research Center (LaRC) Satellite ClOud and Radiative Property retrieval System (SatCORPS) team is producing a number of products that are being used in near real time by the weather forecasting community. Cloud property retrieval and clear sky temperature datasets are being assimilated into a number of operational numerical weather prediction models at NOAA and NASA to improve the location and height of clouds and surface skin temperatures in the model initial analyses. Near-real time detections of hazardous thunderstorms and in-flight airframe icing conditions from supercooled water are being used by NOAA National Forecast Centers such as the Aviation Weather Center, Weather Prediction Center, and Ocean Prediction Center, and Alaska Aviation Weather Unit. The SatCORPS product suite is also used for near real time decision support and flight planning during NASA airborne field campaigns. This presentation will summarize these and other near real time LaRC SatCORPS product applications.
2:20pm	Ryan Boller, NASA GSFC	**Building an NRT Portal (google docs link), PDF Version** This talk will present ways that NASA could customize the Earthdata Search client to better meet the needs of the NRT community. In particular, it will demonstrate options for finding relevant datasets in an application-specific manner. It will also discuss the steps needed to make this a reality.

2:40pm	Molly Brown - Introduction to breakout groups (**breakout group rooms**)	
2:50pm	Portfolio development and gap identification for NRT data products *Outcomes:* • Each group should review the NRT portfolio and further develop the inventory, create a list of data used, data gaps, future data needs, and science questions behind each applications area • Each group must *report at least two conclusions* from the breakout group.	
4:20pm	Reports back from groups (5 minutes each) report back: **group 1** **group 2** **group 3** **group 4** **group 5** **group 6**	*Designated reporter from each group with 1 PowerPoint slide*
5:10pm	Open Discussion, Moderated by David Green, NASA HQ	
5:50pm	Adjourn for the day	

Thursday 29th September 2016

8:00am	Coffee	
	Speaker	Topic
8:30am	Molly Brown and/or Diane Davies	Welcome to Day 3 – Goals and objectives for third day of the workshop

	8:40am	William Blackwell, MIT Lincoln Labs	**Cubesats and related technologies and mission opportunities for low latency data**[1] Cubesats (also known as “U-class” small satellites) flying advanced sensors now enable proliferated constellations with the potential to provide global earth observing data with unprecedented persistence. As an example, the Time-Resolved Observations of Precipitation structure and storm Intensity with a Constellation of Smallsats (TROPICS) mission was recently selected by NASA as part of the Earth Venture–Instrument (EVI-3) program. The overarching goal for TROPICS is to provide nearly all-weather observations of 3-D temperature and humidity, as well as cloud ice and precipitation horizontal structure, at high temporal resolution to conduct high-value science investigations of tropical cyclones, including: (1) relationships of rapidly evolving precipitation and upper cloud structures to upper-level warm-core intensity and associated storm intensity changes; (2) the evolution of precipitation structure and storm intensification in relationship to environmental humidity fields; and (3) the impact of rapid-update observations on numerical and statistical intensity forecasts of tropical cyclones. TROPICS will provide rapid-refresh microwave measurements (median refresh rate of 21 minutes for the baseline mission) over the tropics that can be used to observe the thermodynamics of the troposphere and precipitation structure for storm systems at the mesoscale and synoptic scale over the entire storm lifecycle. TROPICS comprises 12 CubeSats in three low-Earth orbital planes. Each CubeSat will host a high performance radiometer to provide temperature profiles using seven channels near the 118.75 GHz oxygen absorption line, water vapor profiles using 3 channels near the 183 GHz water vapor absorption line, imagery in a single channel near 90 GHz for precipitation measurements (when combined with higher resolution water vapor channels), and a single channel at 206 GHz that is more sensitive to precipitation-sized ice particles. This observing system offers an unprecedented combination of horizontal and temporal resolution to measure environmental and inner-core conditions for tropical cyclones on a nearly global scale and is a major leap forward in the temporal resolution of several key parameters needed for assimilation into advanced data assimilation systems capable of utilizing rapid-update radiance or retrieval data. In this presentation, we explore new measurement capabilities afforded by Cubesat observatories that offer new opportunities for low-latency data collection, using the TROPICS mission to illustrate key points.	

		[1] This work was sponsored by the National Aeronautics and Space Administration under Air Force contract FA8721-05-C-0002. Opinions, interpretations, conclusions, and recommendations are those of the authors and not necessarily endorsed by the United States Government.
9:10am	Christopher Lippitt, University of New Mexico	**Near Real-time Remote Sensing Data and Earth Science Priorities** The potential science enabled by low-latency remote sensing data products is profound; continuous passive monitoring, automated target prioritization based on that passive monitoring, and a dramatic expansion of the decision domains remote sensing can inform are perhaps the most apparent capabilities enabled by near real-time remote sensing data availability. The synoptic perspective of remote sensing has traditionally only been afforded to those who study the past. Time-sensitive remote sensing, or the use of the remote sensing to map, monitor, or measure events as they unfold, has been a challenge due to the logistics of moving and analyzing large quantities data. Advances in computing architecture, data compression, and wireless data transmission point toward a future in which the unique ability of remote sensing can be leveraged to inform time-sensitive prioritization of measurements and responses. This presentation uses the lens of the Remote Sensing Communication Model to identify research and development priorities for realizing the potential enabled by low-latency remote sensing data products.
9:30am	Questions and discussion	
10:00am	Coffee break	
10:20am	Molly Brown	Overview of results from breakout groups on days 1 and 2
10:30am	Panel Discussion, Chair: David Green	Panel Discussion objectives are to discuss the scientific, programmatic and practical consequences of the NRT portfolio and status of the existing inventory, ways we can continue to ensure NRT data is available, discoverable and meets the needs in the coming decade. Chair: David Green Participants: Chris Justice, Kevin Murphy, Michael Goodman Review of Meeting Outcomes: Status of Inventory, Chartered Team and other Findings

12:15pm	**Sanda Cauffman, NASA HQ**	**Closing Remarks**
12:30pm		**Adjourn**

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